Introduction to the Kalaupapa Marine Environment

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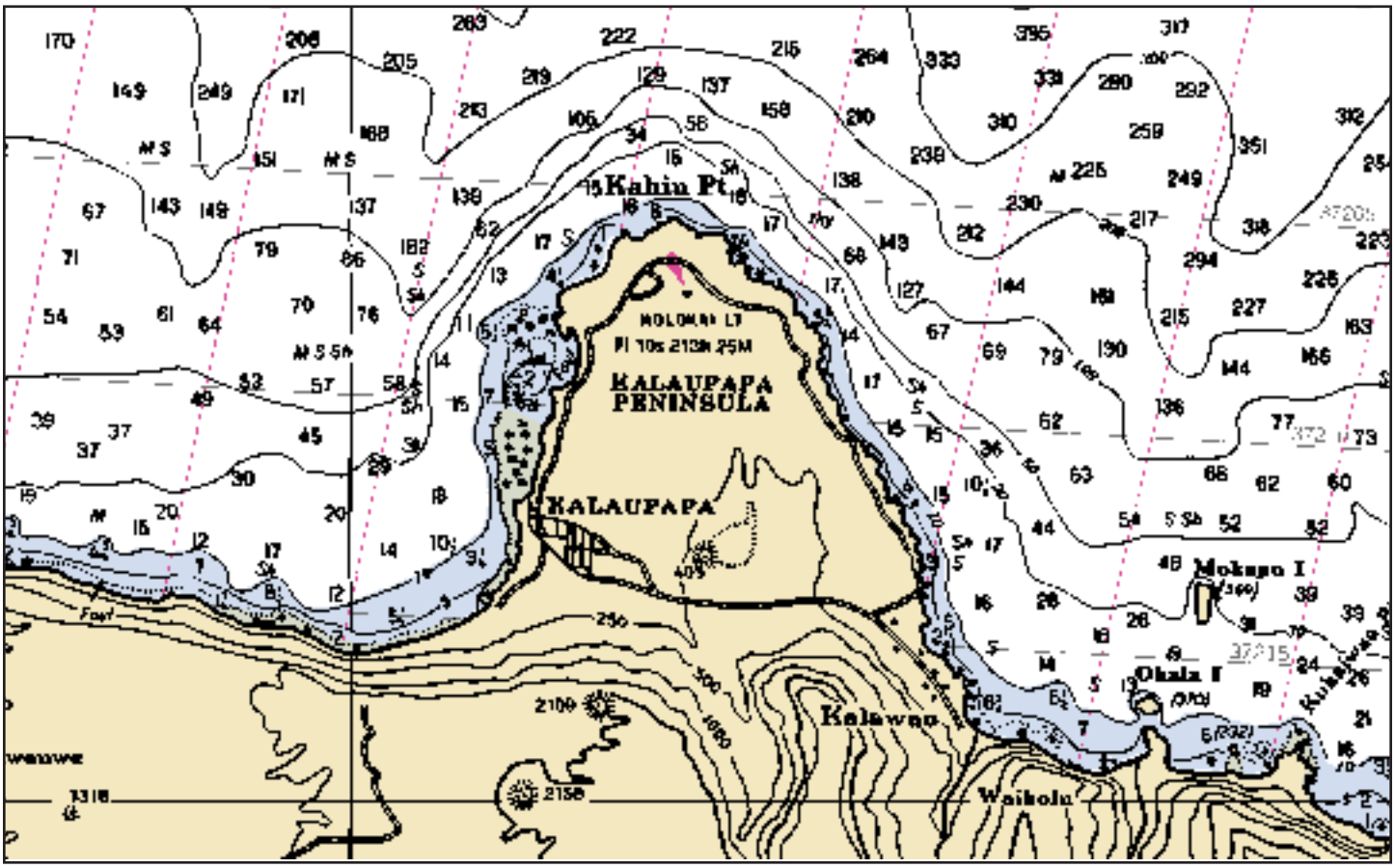
There are approximately 8-9 miles of ocean/land interface at Kalaupapa National Historical Park (KALA). The physical coastline varies from high, nearly vertical cliffs to gently sloping sand covered lava benches. There are several carbonate sand beaches and one gray basaltic sand beach.

The predominate near-shore habitat at KALA is what is referred to in Hawaii as a "reef community" – small isolated coral heads and coral encrustations on a base substrate of basalt. So far I have only been snorkeling but I've yet to see anything that looks like a true coral reef within the boundaries of KALA. We may find differently when get down deeper. At Koloko there is plenty of coral from 50-100 ft deep.

The physical factor which drives the subtidal at KALA is wave energy. Typically waves are 2-3 feet on the western peninsula and 4-6 feet on the eastern. Several time a year wave heights reach 20 feet and higher.

The tidal range is approximately 3 feet from –0.3 to +2.5.

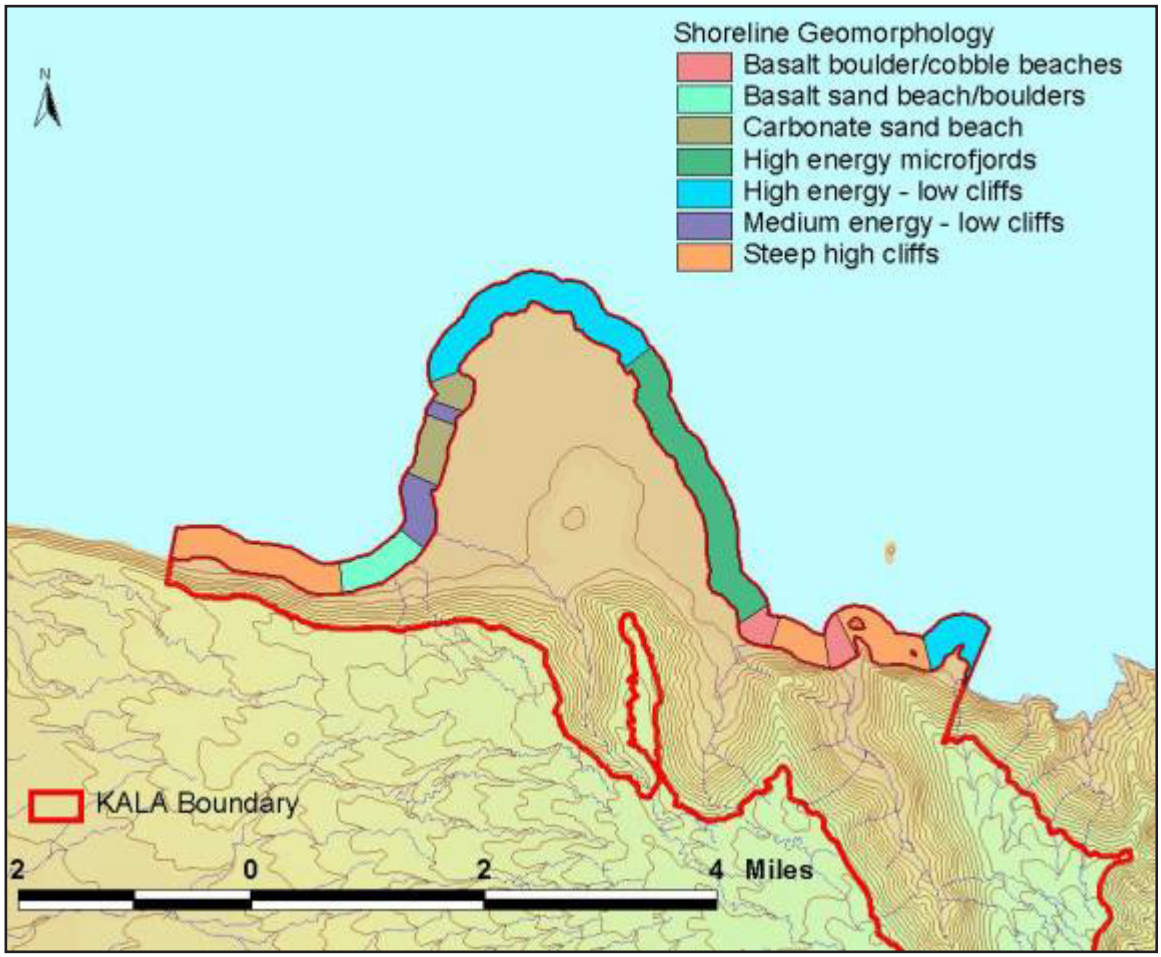
Bathymetry



We still don't have a decent GIS layer that shows bathymetry for KALA.

Shoreline Geomorphology

Note that the actual shoreline is a much narrower band than what is legendized in the map below. To enhance viewing in the map below, the full ¼ mile submerged portion of the park was legendized by the shoreline type. The map does not attempt to show any information about the benthic environment.



Basalt boulder/ cobble beaches:

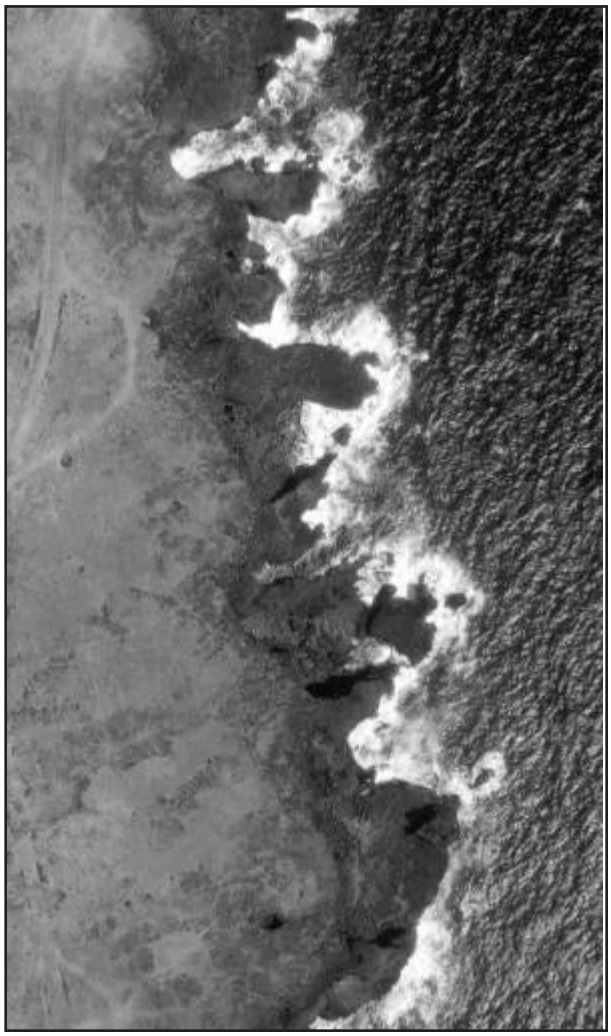
Basalt sand beach / boulders:

Carbonate sand beach:

Above and following pictures: The very shallow sloping bedrock bench in the intertidal and shallow sub-tidal has the appearance of being a ‘coral reef’, but I don’t think so….

Carbonate sand beach:

High energy microfjords:



Right: Aerial photo from 1975, note road for scale

Typical coast in high energy – microfjord area

High energy – low cliffs:

Medium energy – low cliffs on a very calm day

Steep, high cliffs

These cliff often have boulder/cobble beaches at their base wide enough to walk along during low tide with calm seas.

Benthic Substrates

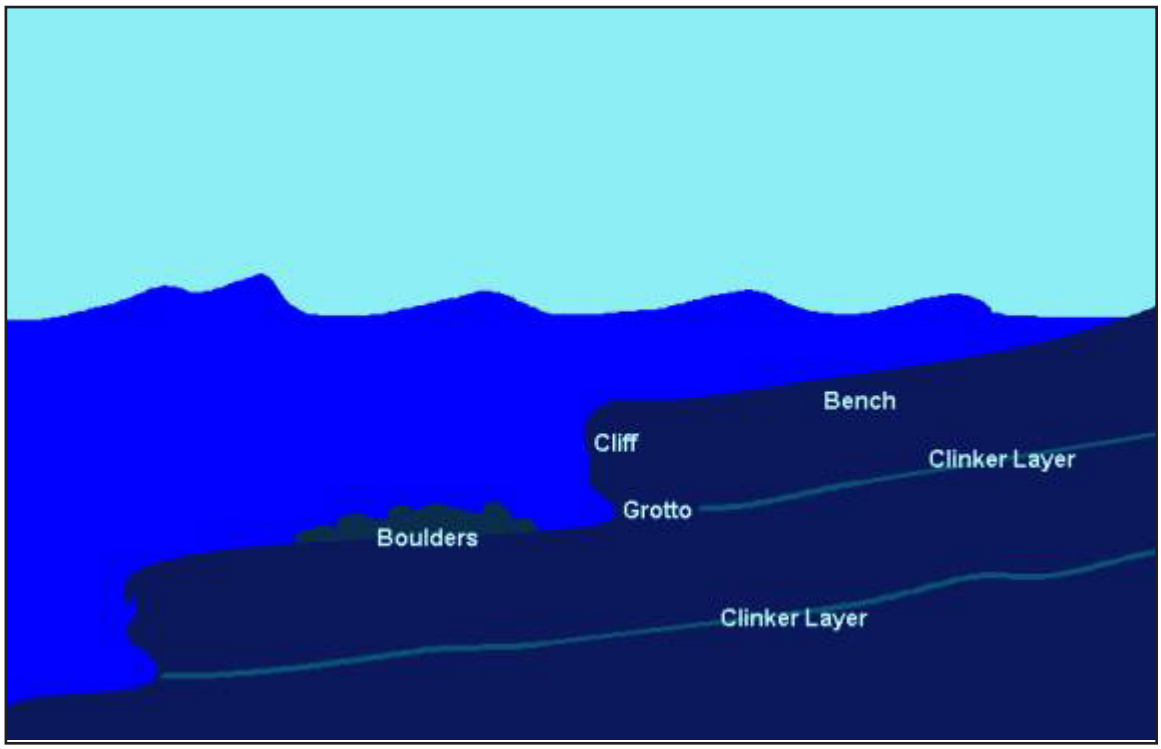
Preliminary surveys at KALA suggest the benthic substrate/slope combinations highlighted below. The predominant benthic substrate types at KALA appear to be bedrock benches and boulder/cobble fields. Sorry folks, no underwater photos yet.

Un-vegetated supra-tidal lava benches and upper intertidal benches (see photo below) at KALA have surface characteristics that appear blocky do to a reticulated network of cracks varying from 0.25 – 2 meters apart. I'll call these 'fracture cracks' until we can come up with a better term.

Bedrock benches

Bedrock Benches. Bedrock lava benches or 'pavement' are probably the dominant benthic substrate type around the KALA peninsula. In the subtidal, the fracture cracks described above are often rounded on the bottom. Rock-boring urchins are often seen in the cracks. Additional groves approximately the widths of the urchins are sometimes abundantly observed extending outward from the fracture cracks.

On very shallow sloping intertidal and subtidal benches, the bedrock become covered with sand and coralline algae. The fracture crack networks often appear to be filled by calcified rubble and sand, cobbles and pebbles. This habitat occurs subtidal and intertidal of the 'Carbonate sand beaches' shown on the shoreline map.



Bedrock cliffs. Along much of Kalaupapa's coast, lava flows are 1-3 meters in thickness. Many submerged cliffs are created at the erosional 'end' of a single lava flow. As with most lavas from older volcanoes, the central portion of the flow appears denser with friable clinker layers above and below.

The diagram shows a cross-section through a typical medium energy, low cliff coastal area. Submerged cliffs along the peninsula are typically composed of one to two lava flows and are 1 to 3 meters in height. In high energy areas the distance between cliffs is less.

Multi-layer lava flow cliffs are created where massive slumping has occurred. These submerged cliffs may descend vertically hundreds of feet and are reported to occur principally along the eastern and western park boundaries at the base of the north shore pali.

Small caves I'll call 'clinker grottos' often occur at the bases of lava flow cliffs and on cliff faces. Clinker grottos commonly develop at the erodable clicker interface between the dense portions of two lava flows.

Boulder/cobble/pebble fields. Boulders in Kalaupapa's benthos are often large (1 to 8 m dia.) and well rounded. In some boulder fields the interstitial spaces are filled with cobbles, coral rubble and sand but in most boulder fields the sacrificial interstitial spaces are largely clear of debris. As I snorkel above, fish are often seen entering these spaces. Boulders fields are not always continuous – bedrock often appears beneath boulders. The boulders are in essence resting on bedrock benches.

Coraline algae encrustations, coral and coral debris on basalt.

Calcium carbonate sand.

Basaltic sand.